brown above, with numerous dark olive cross-bands, most of which are broken up on the vertebral line, their moities alternating; head uniform dark olive; whitish beneath, closely speckled with dark brown.

Total length 455 millim.; tail 80.

Jampea Island; a single specimen.

Sphenophryne variabilis.

Tongue large, oval, entire. Snout short, rounded, with feebly marked canthus; interorbital space broader than the upper eyelid; tympanum feebly distinct, two thirds or three fourths the diameter of the eye. Tips of fingers dilated into very large disks; first finger shorter than second; toes short, free, the disks much smaller than those of the fingers; no subarticular or metatarsal tubercles. Skin smooth. Coloration very variable. Grey, brown, purple, pink, or crimson above, uniform or with darker marblings, or with a lighter yellow or pink lateral streak; a light vertebral line sometimes present; sides of head usually dark brown; a dark, light-edged ocellus may be present on the lumbar region; beneath uniform whitish, or greyish with yellow spots, or dark brown with yellow spots.

From snout to vent 28 millim.

Bonthain Peak, Celebes, 5000–6500 feet; numerous specimens were collected by the Drs. Sarasin and by Mr. A. Everett.

VIII.—*Animal Temperature as a part of the Problem of Evolution.* By M. QUINTON*.

I.—THE temperature which governs the chemical reactions of life depends upon two factors—(1) the temperature of the surrounding medium, (2) the calorific power proper to the animal. The temperature of the surrounding medium in this respect is of such importance that the isocrymal lines or the lines of greatest cold are confused with the lines indicating the distribution of species on the surface of the globe.

Fossil flora discloses the fact that the temperature of the globe has been always on the decline; in ancient epochs it was very high. We must therefore ask under what thermic conditions the chemical phenomena of life were carried on,

* From the 'Comptes Rendus,' tome cxxii. pp. 850–853 (1896).

and how they have been kept up in the colder epochs which have succeeded.

II.—The chemical phenomena of life were at first manifested under very high temperatures; in addition to the proofs furnished by a study of the flora I would add the following:—The invertebrates, the first vertebrates, had a heat-producing power which might be reckoned as *nil*, or, at least, very feeble. Though they were animals of low chemical temperature, I consider that they confirm by this very absence (of heat-producing power) the conditions of high temperature under which they lived. A heat-producing capacity capable of raising their temperature above that of the surrounding medium was wanting, for the simple reason that there was no need for it.

Figures lend still further probability to this life at high temperatures. The silkworm nurseries are kept at 40°; the tortoise can withstand a stove-heat of 40°; Spallanzani and Sonnerat have trained certain fish not only to live but to reproduce their kind at 40°–44°; M. Marey cites the case of a *Gymnotus* which throve at 41°; a python incubates at 41°·5 (Valenciennes): all which temperatures would, as is known, be rapidly fatal to man.

These invertebrates and primary vertebrates in our day lead but a very precarious life outside of the tropics. They do not survive the first frosts of autumn or become torpid; the chemical phenomena of life are suspended, the venous and arterial blood of the hibernating reptile become mingled. Their very survival is to be explained by a modification of their chemical processes; in the laboratory, mammalian pepsine is only active on food at a temperature of about 38°, reptilian pepsine is still active at 0°.

III.—The first animals lived, then, by the high temperature which they received from their environment. What did life become as this temperature fell? Two logical hypotheses present themselves:—

A. Either life continued at the temperature of the surrounding medium. In this case it modified the reactions of its chemical phenomena and adapted them to the lower tempetures (cold-blooded animals, reptilian pepsine).

B. Or it attempted to maintain artificially the temperature of its chemical phenomena, and to this end created for itself a function which gave rise to the production of heat. In this case life must always submit to the general law of adaptation and lower progressively in each new species the temperature necessary for the production of its chemical phenomena.

Thus theoretically:—(1) The heat-producing function took its origin in the cooling of our globe, it accommodated itself to and *only increased with it*; (2) the chemical temperatures, in ancient times very high, have always decreased, either in order to produce equilibrium or to adapt themselves to the surrounding medium.

We may thus divide existing animals into two groups—one making its appearance on the globe in ancient times, the other in modern. The ancient group having ceased its evolution at epochs still but little cooled, has theoretically only acquired a feeble heat-producing power. The animals of this group which have been continued to our times (such as the Monotremata, Marsupialia, Edentata, Amphibia, Chiroptera, and hibernating animals) ought *à priori* to exhibit a very feeble heat-producing power, the *feebleness being proportional to their antiquity.*

The chemical temperature being dependent upon two factors (the surrounding medium and the heat-producing capacity), the actual temperature of these animals, *à priori* very low, ought to form a scale of species in the order of their appearance on the globe.

Empiricism accords with theory. I take the first two figures of the list which follows from a recent work by M. R. Semon; the rest are my own:—

Ornithorhynchus, 25° at an external temperature of 20°; *Echidna*, 30° at 19°; *Opossum*, 33° at 20°; *Armadillo*, 34° at 16°; *Hippopotamus*, 35°·3 at 11°; *Myopotamus* (*Coypu*), 35°·5 at 20°; *Vampire*, 35°·5 at 18°; *Elephant*, 35°·9 at 11°; *Marmot*, 37°·3 at 20°; *Llama*, 37°·6; *Ass*, 37°·7; *Camel*, 37°·9; *Horse*, 38°.

In the group of animals whose date of appearance on the globe is recent, on the contrary, the animal having prolonged its evolution into the cold period will have gradually acquired a higher heat-producing capacity tending to the maintenance of the ancient high vital temperatures. These will only have fallen in consequence of adaptation to environment; in this group their fall will be a measure of their recentness.

It is this which confirms the following list. Some of the temperatures are the result of single observations; the observers are different; their absolute value is very restricted, but suffice to confirm the induction:—

Bird, 42°; ox, 40°; hare, 39°·7; pig, 39°·7; rabbit, 39°·6; eland, 39°·4; she-goat, 39°·3; dog, 39°·3; cat, panther, 38°·9; squirrel, 38°·8; rat, 38°·1; monkey, 38°·1; man, 37°·5.

The indications of these two lists are in an inverse direction. In the first the fall of temperature results, so far as the animal is concerned, from the feebleness of its heat-producing capacity, a feebleness proportional to its antiquity; in the second from its adaptation to the environment, an adaptation proportional to its recentness.

IV.—There results from this empiricism confirming the induction:

(1) That life in its evolution accommodates itself to the cooling of our globe; that it began at very high temperatures, that at first it had for its chemical medium no other temperature than that of the surrounding medium.

(2) That as the temperature fell the heat-producing capacity came into existence; its origin becomes clear; the heat-producing capacity, a function of cooling, determines with the animal temperatures the order of the appearance of species; lastly, that the class Mammalia is not composed solely of so-called warm-blooded animals, but that it comprises a whole group which may truly be called cold-blooded.

IX.—*On a small Collection of Lepidoptera sent from Nyasa in* 1895 *by Mr. R. Crawshay.* By Arthur G. Butler, Ph.D. &c.

Although the present consignment includes only one new species, it is exceptionally interesting, not only as comprising several links between described species, but on account of the important additional evidence afforded by the careful dating of the captures; so that now it is possible, by comparing these with Mr. Crawshay's previous consignments, to prove conclusively that several very distinct forms declared to be seasonal and conspecific occur together repeatedly in various months of the year—that, in fact, they are not confined to any particular season, and have no more evident claim to be called forms of one species than our European *Vanessa c-album* or *V. polychloros* have to be called forms of *V. urticæ.*

1. *Melanitis leda,* var. *solandra.*

Papilio solandra, Fabricius, Syst. Ent. p. 500 (1775).

Deep Bay, W. coast of Lake Nyasa, Feb. 14th, 1895.

"Dusky brown Thicket, eyed upper wing. Delicate, almost impossible to kill a perfect specimen" (*R. C.*).